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HANDBOOK ON SANITATION OF VESSELS IN OPERATION. SANITATION FEATURES AND FACILITIES ON VESSELS IN OPERATION

Public Health Service
Washington, D. C.

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HANDBOOK ON SANITATION OF

Vessels in Operation

SANITATION FEATURES AND FACILITIES ON VESSELS IN OPERATION

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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service

Division of Environmental Engineering and Food Protection
Washington 25, D.C.

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FOREWORD

This publication was prepared by the Interstate Carrier Branch of the Division of Environmental Engineering and Food Protection, Public Health Service, and is one of a set of three handbooks on the subject of vessel sanitation. The others are "Handbook on Sanitation of Vessel Construction," PHS Publication No. 393, and "Handbook on Sanitation of Vessel Watering Points," PHS Publication No. 274.

The standards contained herein are intended to serve as a guide to representatives of the Public Health Service who make inspections of operating vessels under United States registry and to persons charged with supervising sanitation facilities aboard these vessels. The material in this handbook will not, of course, agree in all cases with the statements in the "Handbook on Sanitation of Vessel Construction," as the latter pertains to new construction, reconstruction, or major repairs.

The basic law authorizing the Public Health Service to prepare regulations to prevent the transmission or spread of communicable disease is Public Law 410 of the Seventy-eighth Congress, section 361 (a) of which reads as follows:

> The Surgeon General, with the approval of the Secretary, is authorized to make and enforce such regulations as in his judgment are necessary to prevent the introduction, transmission, or spread of communicable diseases from foreign countries into the States or possessions, or from one State or possession into any other State or possession. For purposes of carrying out and enforcing such regulations, the Surgeon General may provide for such inspections, fumigation, disinfection, sanitation, pest extermination, destruction of animals or articles found to be so infected or contaminated as to be sources of dangerous infection to human beings, and other measures, as in his judgment may be necessary.

It should be understood at the outset that the standards appearing on the following pages do not have the legal force of the Interstate Quarantine Regulations; nevertheless, they were written with a view to conforming to the intent of the regulations. Compliance with these standards, therefore, will insure compliance with the regulations. In the event of noncompliance with a standard, however, and failure to correct the reported condition, final corrective action will be based upon the applicability of the regulations concerned.

The several associations representing operating vessel companies have been extremely helpful in reviewing the drafts of this handbook, and their suggestions for improvements have made it possible to produce a more realistic and practical guide to desirable practice than would otherwise have been possible.

Improved methods and equipment undoubtedly will be developed from time to time. These, in turn, will lead to changes in existing requirements for sanitary practices and procedures. Such developments will be included in supplements to or revisions of this handbook as circumstances require.

Section I. POTABLE WATER

To insure the flow of safe water from outlets used for drinking and culinary purposes on a vessel, it is necessary first to load or manufacture water of drinking water quality. Next, the sanitation facilities built into the vessel must be utilized in a manner which prevents contamination of the water during normal ship operations. The necessary sanitary practices and safeguards which must be observed if water used on shipboard is to be used free of harmful contamination are discussed in this publication. Some of the suggestions that follow, however, are not applicable to vessels that do not load water from shore sources.

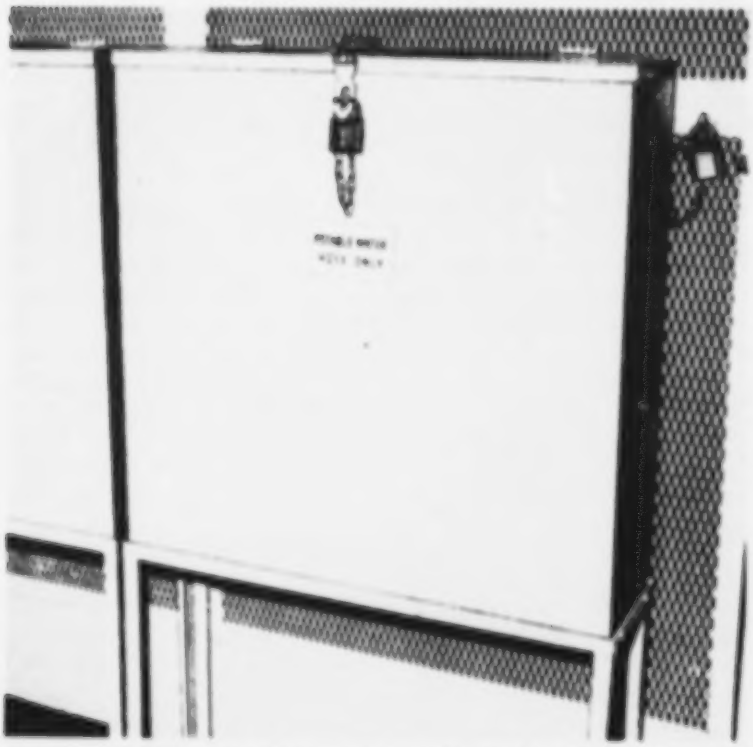
1.1 SOURCE OF POTABLE WATER. In ports of the United States and its possessions potable water for vessels should be obtained only from water supplies and at watering points (including waterboats) approved by the Surgeon General of the Public Health Service. A responsible officer on the vessel should determine, by consulting the current Official Classification of Vessel Watering Points, whether or not the water obtained from any pier, dock, or waterboat is potable. This Public Health Service listing may be obtained from the nearest Regional Office of the U.S. Department of Health, Education, and Welfare, Public Health Service. A copy should be kept on all operating vessels of United States registry, with the exception of those which do not load shore water.

1.2 FILLING HOSE. A separate hose should be kept on each vessel and used only for loading potable water. Under no circumstances should non-potable liquids pass through it. If there is a hose at the pier where potable water is loaded, none need be kept on the vessel. If the specific needs of the vessel are not known, at least two 50-foot sections of hose should be provided for this purpose. This hose should be durable, with a smooth impervious lining, and should be equipped with the fittings necessary to permit connection to the source hydrant and filling line. The hose should be handled so that the ends are not dragged through or accidentally dropped into contaminated water, or otherwise contaminated.

1.3 FILLING HOSE STOWAGE. The potable water hose and such hydrant adapters as may be required should be stowed in a closed cabinet, on a rack or reel, or hung on brackets and located near the vessel's filling line connection, preferably on the bulkhead adjacent to the filling line connection so it will be easily accessible at all times. This will minimize

the possibility of crew members using another hose, one which might be contaminated. These facilities should be installed at least 18 inches above the deck.

The hose cabinet or stowage space should be clearly marked by means of ½" lettering (minimum) stamped on a noncorrosive label plate, or equivalent, reading "POTABLE WATER HOSE ONLY." The words "Drinking" or "Culinary" are acceptable on signs already in place. The word "Fresh" is not acceptable if it applies to the potable water system.



Among the methods suggested for protecting potable water filling hoses is the stowage cabinet.

1.4 PROTECTION OF HOSE ENDS. If the hose is not stowed in a closed cabinet, the ends should be plugged or capped with threaded metal fittings to minimize contamination of the inside surface. These fittings should be secured by short keeper chains to the hose, or to the supporting brackets at the end of the hose. The hose should be stowed high enough above the deck to prevent submergence in deck wash water.

1.5 FILLING LINE CONNECTIONS. Potable water filling lines should be connected only to potable water tanks and should not be cross connected to any line of a nonpotable system. Filling lines that have a piping arrangement for diverting potable water from an approved source to nonpotable water systems by means of valves (unless an air gap follows the valve) or interchangeable pipe fittings are not acceptable. Where one filling line is used to load only potable water to all tanks, a direct connection to the potable water tank and to the supply going to other tanks through an air gap would be satisfactory.

The filling line should be fitted with a screw cap secured to the line or adjacent bulkhead by a keeper chain. The keeper chain should be sufficiently short to keep the cap off the deck or other horizontal surfaces.

1.6 FILLING LINE INLET. The potable water filling line inlet should be located at least 18 inches above the deck to facilitate attaching the hose and to minimize the possibility of contaminating the water. The inlet

Potable water filling connection on a tanker.

should begin either in a horizontal position, a gooseneck, or a vertical position, with the open end down.

1.7 FILLING LINE IDENTIFICATION. The potable water filling line should be clearly marked by means of ½" lettering (minimum) stamped on a noncorrosive label plate, or equivalent, located near the filling line, reading "POTABLE WATER FILLING" to avoid piping nonpotable liquid through this connection. Signs on which the word "Drinking" or "Culinary" is used are acceptable if already in place. The word "Fresh" is not acceptable if it applies to the potable water system.

1.8 TANK FEATURES AND LOCATION. The construction features and location of the potable water tank should be such as to prevent contamination of its contents. Preferably, it should be located above the highest point of the bilge. The surrounding area should be adequately drained to prevent submergence of the tank in bilge water.

1.9 INDEPENDENT TANK. A potable water tank should be independent of the shell of the vessel. A skin tank may be used if the bottom of the tank is at least 2 feet above the maximum LWL and the seams of the tank are continuously welded on the inside. There should be no rivets in any seam of the tank. If a skin tank does not meet these conditions it is not satisfactory for the storage of potable water. Possible methods of correction might include chlorination with a 20-minute retention period before delivery to the distribution system, or the construction of a cofferdam between the shell and the tank. Both would involve major structural changes,[1] but these would not be required if the vessel were built prior to June 1947.

1.10, 1.11 TANK BOUNDARIES. The potable water tank should have no common partition with a tank containing nonpotable liquids. As in item 1.9, possible methods of correction might include chlorination followed by a 20-minute retention period, or construction of a cofferdam, both of which would involve major structural change. Again, compliance with this item will not be required on a vessel built prior to June 1947 (*see footnote*).

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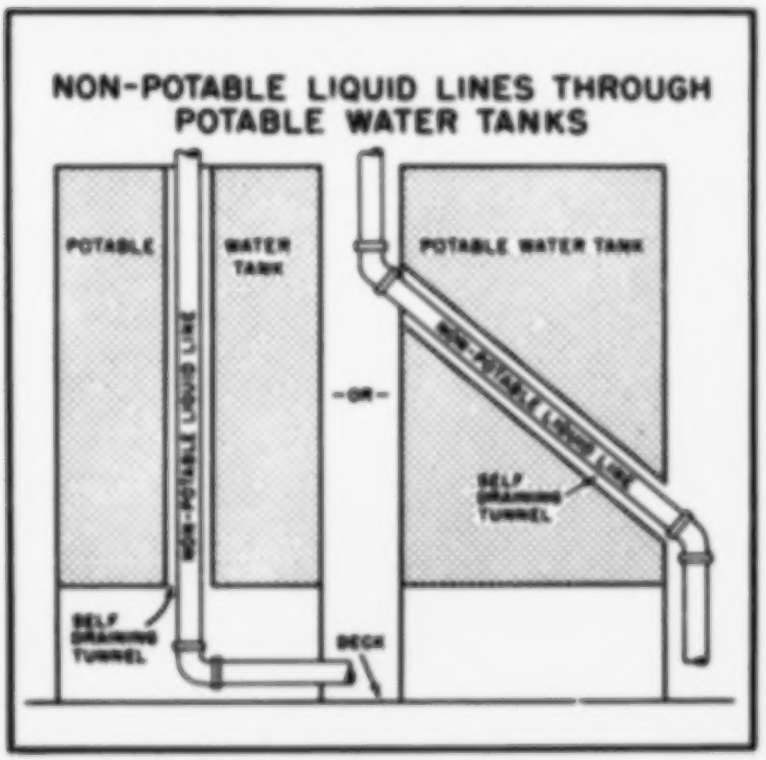
[1] *For the purpose of this handbook, a major structural change, the definition of which has raised numerous questions in the industry, is defined as one involving any extensive alteration in the structural arrangements and features of a vessel. It is not necessarily involved in the rearrangement and location of pressure piping or the addition of a chlorinator when no retention is necessary (as in the chlorination of a wash water system). A major structural change would be involved, however, if a cofferdam or a chlorinator with retention tanks were added. On smaller vessels where the problem of providing retention tanks may not be significant, a major structural change may not be necessary. As defined herein, a major structural change applies only to the recommended practices set forth in sections I–IV of this handbook and to both interstate carriers and U. S. flag vessels in foreign trade.*

Where the top of the potable water tank serves as a deck, there should be no access or inspection openings into the tank unless it is constructed so as to minimize the possibility of contaminating the water in it. The seams of such a tank should be continuously welded on the inside. There should be no rivets in the top of the tank.

1.12 IMPROPER USE OF TOP OF TANK. No toilet or urinal should be located on that part of a deck which forms the top of a potable water tank. Where this condition exists, its correction will involve a major structural change which, however, need not be made on vessels built prior to June 1947 (see footnote, p. 4).

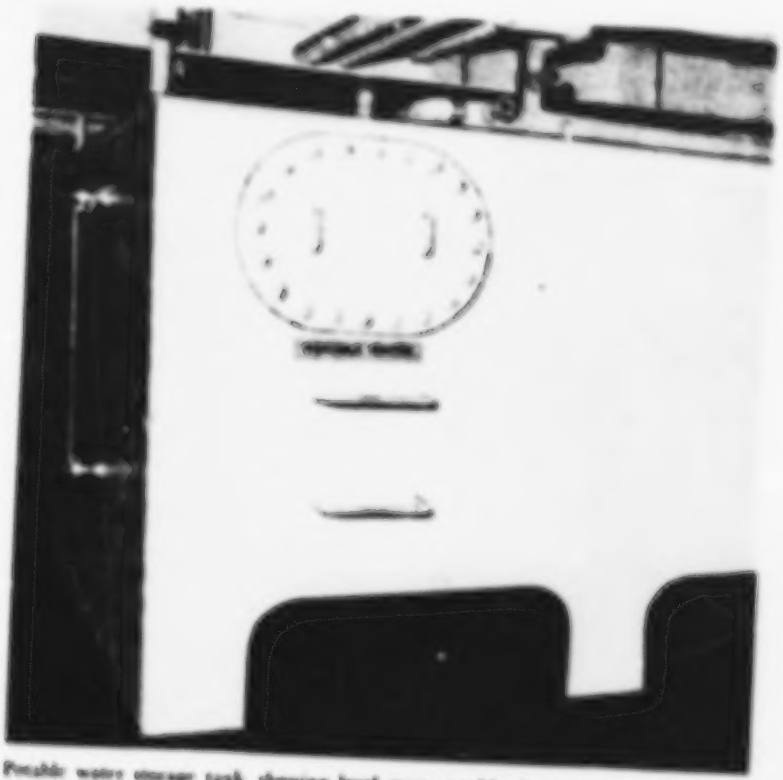
1.13, 1.14 LINES THROUGH TANKS. No potable water lines (including suction, filling, vent, overflow, and drain) should be piped through nonpotable liquids. Likewise, no nonpotable water lines should pass through potable water tanks.

Where these conditions* are not satisfactorily met, it may be necessary to reroute the lines around the tank. As an alternative to rerouting the line



the pipeline through the tank could be surrounded by a tunnel open at the bottom end to allow complete self-drainage at all times. Horizontal tunnels should be made of extra heavy plate. They should be installed on a continuous slope and the lower end should be open for continuous drainage. The installation of a pipe tunnel would involve a major structural change which will not be required on vessels built prior to June 1947 (see footnote, p. 4).

1.15 TANK IDENTIFICATION. Potable water tanks should be clearly marked by means of ½" lettering (minimum) stamped on a noncorrosive label plate or equivalent, reading "POTABLE WATER." Label plates on which the word "Drinking" or "Culinary" is used are acceptable if already in place. The word "Fresh" is not acceptable if it applies to the potable water system.



Potable water storage tank, showing level gage, combined vent and overflow, and manhole.

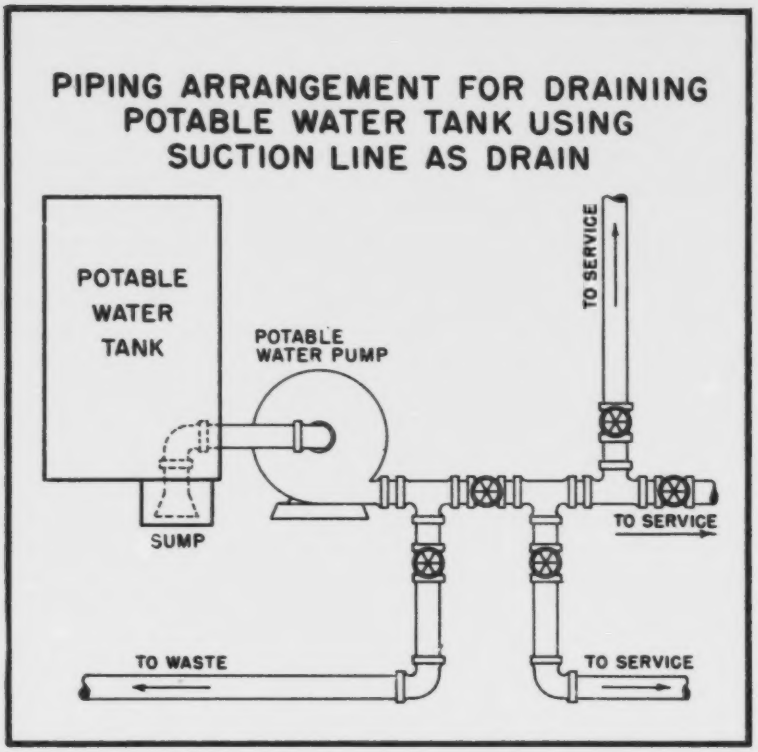
1.16 MANHOLES. A manhole to a potable water tank is not required. However, where one exists, its construction features and location should be such as to minimize the possibility of contaminating the water in the tank. If the manhole is located in the side of the tank, flush-type construction is acceptable. If located in the top (including the deck, if the deck forms the top of the tank), a coaming or curb rising at least one-half inch above the top of the tank should be provided, and the manhole cover should extend to the outer edge of the curb or flange. The cover should have a gasket and a device for securing it in place. If a nonwatertight, hinged or slip-on cover is used on a curbed manhole, it should overlap the outer edge of the curb and extend toward the tank for a distance of at least 1 inch. Such a cover should not be used on tanks where accidental overflow might subsequently result in contamination of the potable water supply. The hinged or slip-on type of cover is not recommended for a potable water tank when the top of the tank is formed by a deck.

1.17 OVERFLOWS. The potable water tank should be provided with an overflow or relief valve which should be so located that the test head of the tank is not exceeded. The overflow should be constructed and protected in the same manner recommended for vents in item 1.18 below.

1.18 VENTS. Potable water storage tanks should be provided with a vent so located and constructed as to prevent the entrance of contamination. A single pipe without take-offs may be used as a combined vent and overflow. The combined cross sectional area of the vent and overflow should be equal to or greater than the cross sectional area of the filling line to the tank, unless the tank is provided with a relief valve. In this case, the vent pipe should be at least 1¼ inches in diameter. A potable water tank vent should not be connected to the vent of any tank holding nonpotable liquid. The vent or combined vent and overflow should terminate with the open end pointing downward and should be screened with 16 mesh or finer corrosion resistant wire. It may terminate at the side of the tank near the bottom of the ship if the end is above normal bilge level and is readily inspectable, or a distance of 18 inches above a weather deck in a sheltered space. When it must be exposed to wave action, it should be equipped with a backwater (check) valve.

1.19 TANK DRAINAGE. The potable water storage tank should be equipped with a drain. The drain should be large enough to permit rapid drainage of the tank, preferably the size of the inlet pipe, but in no case less than 1¼ inches in diameter. Drainage may be from a separate pipe or from such other pipelines as pump suction or transfer lines leading from the tank. If pump suction or transfer lines are used, there should be no

take-off to the distribution system between the tank and the discharge point in the line. In order to insure complete drainage of a tank's contents, the drain line leading from the tank should be flush with or below the inner surface of the tank bottom.



1.20 WATER LEVEL GAGES. If desired, a measuring device for determining the amount of or depth of water in the potable water tanks may be used. Sounding lines or rods should not be used. Acceptable measuring devices might include:

1. A water gage glass, with shut-off valves on the side of the tank;
2. Petcocks at appropriate intervals on a protected, accessible surface of the tank;
3. Petcocks installed in a vertical offset pipe connected to the tank near the bottom and returned to the top of the tank, or terminated in a gooseneck above the outlet;
4. Water level indicators actuated by air pressure (the air may be supplied by hand pump or independent compressor, or through a "press-on" valve with a filter or liquid trap installed in the supply line from the main compressed air system);
5. An enclosed float gage; or
6. A water-operated pressure gage.

Whatever method of measurement is used, the construction features should be such as to prevent the entrance of contaminating substances into the potable water system.

1.21 PRESSURE TANKS. The potable water pressure tank should not be cross-connected to nonpotable water tanks through the main air compressor. Among the acceptable devices for compressing air into a potable water pneumatic tank are: a "snifter" (air intake) air valve on the potable water pump of the displacement type, an independent compressor, or a "press-on" valve. It would be desirable, although not required, to install a filter or liquid trap in the supply line running from the main compressed air system. The liquid trap should be installed as close to the pressure tank as possible, and should not be less than 2 inches in diameter and 8 inches in length. The press-on type valve will minimize the possibility of contamination because the cross connection with a common air compressor system will be only momentary. Where a common compressed air system supplies pressure to both a nonpotable and potable water pneumatic tank, the air supply to all tanks should be via a press-on type of air valve and hose. A press-on type air valve is one which must be held in place manually and which cannot remain connected without such manual holding.

1.22 POTABLE WATER PIPELINES. Lead pipe and/or cadmium-lined pipe or fittings should not be used in potable water systems.

1.23 POTABLE WATER IN MEDICAL CARE SPACES. Hot and cold potable water should be piped to hospital and medical care spaces for handwashing incidental to medical treatment.

1.24 IDENTIFICATION AND MARKING. The piping of a potable water system should be suitably stenciled, painted light blue, or striped with 6-inch blue bands at fittings, on each side of partitions, decks, and bulkheads, and at intervals not to exceed 15 feet in all spaces except quarters, dining rooms, salons, and other public places where the interior finish would be marred.

Either the bodies of valves installed in that part of the potable water system which is marked should be painted light blue or the valve wheel should be appropriately labeled.

1.25, 1.26 CROSS CONNECTION. There should be no cross connection between the potable water system and any system carrying nonpotable liquids. The potable water system should be free of blind flanges, manifolds, fittings, or valving arrangements producing a cross connection with a nonpotable water system. Blanked flanges in which spool sections can

be inserted are unacceptable, even though no hazard exists until the spool section is placed in the line.

In the event a cross connection is found, and it is reasonably certain that nonpotable water has been introduced into the potable water system, the entire system should be disinfected as outlined in item 1.32.

1.27, 1.28 ICE FOR DRINKING OR CULINARY PURPOSES. Only potable water should be used for making ice that will come in contact with food or drink.

If ice is obtained from shore sources, facilities should be provided on the vessel for delivering, storing, washing, and handling it. These facilities should be used for no other purpose.

Ice should not come in contact with water in coolers.

1.29 DRINKING FOUNTAINS. The water contact surfaces of drinking fountains should be kept clean.

The jet of a drinking fountain should be inclined and the orifice of the jet should be protected by a guard to prevent its contamination by water dropping from the mouth, physical contact with the lips, or splashing from the basin. The orifice of the jet should be at least three-fourths inch above the rim of the basin.

Coolers which permit direct contact of ice and water, and coolers which consist of a cooling chamber into which a water-filled bottle is inserted in an inverted position, should not be used for dispensing drinking water.

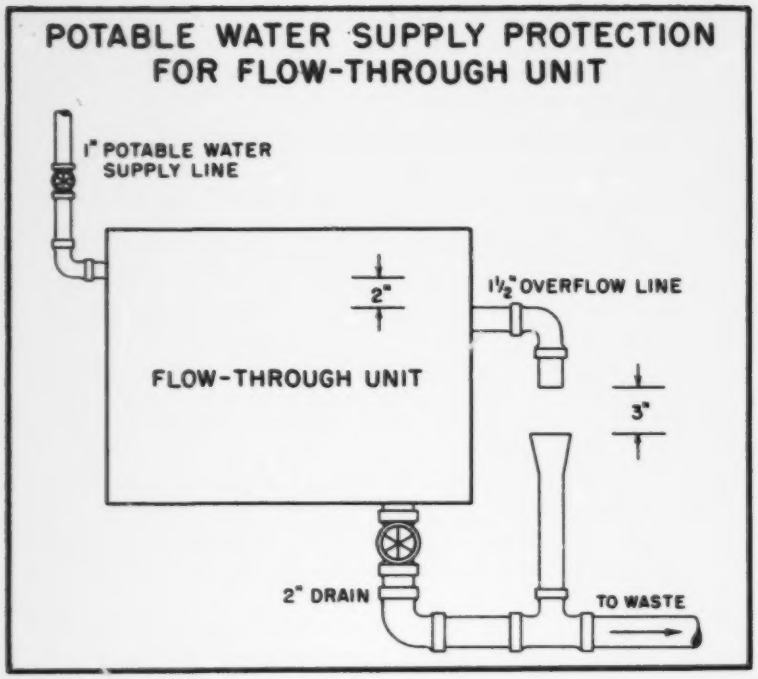
The use of common drinking cups should not be permitted.

1.30, 1.31 BACKFLOW PREVENTER. A potable water system supplying water under pressure should be protected against backflow by a suitable backflow preventer (vacuum breaker) or air gaps which deliver the water from a point above the overflow rim of the unit.

Vacuum breakers where required should be installed in the supply line on the discharge side of the last control valve at least 4" above the flood-level rim of the fixture, or in accordance with the critical distance indicated in the latest edition of the Public Health Service "List of Acceptable Interstate Equipment for Interstate Carrier Use."

An air gap is the unobstructed vertical distance through the free atmosphere between the lowest opening from any supply pipe or fixture drain and the flood-level rim of the receiving receptable. The air gap should be at least twice the diameter of the orifice from which the water is being discharged. The air gap should be measured vertically, from the top of the receiving funnel to the lower end of the discharge pipe.

Potable water delivered to a waste disposal unit, to hospital equipment, to certain equipment used in the preparation or processing of food, or to equipment used when eating and drinking, should be discharged



above the flood-level rim or through an air gap. Where this is mechanically impracticable or water under pressure is required in the unit, a backflow preventer may be used. If above-the-rim delivery, or a vacuum breaker on the discharge side of the control valve, is not practicable on a drinking glass rinser or a similar flow-through unit, a 1½-inch or larger waste drain or an overflow opening at a point at least twice the water-pipe diameter below the water inlet is satisfactory. However, the waste discharge should be through an air gap reasonably close to the unit. A direct connection of the potable water system to a coffee urn or to the top of a steam kettle is satisfactory.

The delivery of potable water to a nonpotable water system and to sinks, wash basins, bath tubs, laundry trays, clothes-washing machines, boiler water spill tanks (hot wells), or similar receptacles, should be made through an air gap.

There should be no direct or continuous connection between the potable water system and an aspirator or ejector, or other hydraulically operated device, or for the cooling of machinery. A hot water heating system or air-conditioning circulating water system should not be supplied directly from the potable water system unless the circulating system is closed, has no nonpotable water connections, and the water is not used for heat exchange purposes in a unit containing toxic materials.

Individual air gaps should be placed in the drain lines of certain types of fixtures, such as water-bath sterilizers, hospital water stills, autoclaves, and all hospital and food handling equipment which may be subject to subatmospheric pressure.

1.32 DISINFECTION OF POTABLE WATER SYSTEM. Any portion of the potable water system which has been repaired, contains replacements, or has been contaminated, should be cleaned, disinfected, and flushed before the affected units are placed in operation as a part of the system, or whenever the system otherwise has become contaminated.

Chlorine compounds used for disinfecting potable water systems are: chlorinated lime, high-test hypochlorite (H. T. H.), perchloron, pittchlor (or their equivalent), or commercially prepared liquid sodium hypochlorite (chlorox, zonite, or their equivalent). Chlorinated lime and liquid sodium hypochlorite can be purchased at almost any grocery or drug store. As these compounds deteriorate on exposure to air, they should be purchased in small containers. The tops of the cans or bottles containing unused compounds should be tightly replaced after use. All products should be kept in a cool, dark place. The instructions that follow should be observed when potable water systems are disinfected with chlorine compounds:

(A) Thoroughly flush the affected part of the distribution system with potable water;

(B) Determine the volume of water necessary to fill completely the affected tank and/or distribution system. The amount of disinfecting agent required is shown below:

TABLE I.—*Emergency chlorination for disinfecting potable water system*

Tank capacity		Amount chlorine compound required for 50 p. p. m. solution						Increments of thiosulfate for dechlorination	
		Chlorinated lime, 25 percent		H. T. H. or perchloron, 70 percent		Liquid sodium hypochlorite			
Gal.	Tons					1-percent solution	5-percent solution		
		Lb.	*Oz.*	*Lb.*	*Oz.*	*Gal.*	*Gal.*	*Lb.*	*Oz.*
250	1	--	7½	--	2½	[1] 5	[1] 1	--	2½
500	2	--	15	--	5	2½	½	--	5
1,000	4	1	14	--	10	5	1	--	10
1,500	6	2	13	--	15	7½	1½	--	15
2,000	8	3	12	1	4	10	2	1	4
2,500	10	4	11	1	9	12½	2½	1	9
3,000	12.5	5	10	1	14	15	3	1	14
4,000	17	7	8	2	8	20	4	2	8
5,000	21	9	6	3	--	25	5	3	--

[1] Quarts.

NOTE 1.—A heaping tablespoon holds approximately ½ ounce, a measuring cup approximately 6 ounces. Standard measuring devices are preferable.

NOTE 2.—For larger tank capacities, use appropriate multiples of those given.

When chlorine compounds or solutions other than those noted in the table are used, the dosage should be

$$\text{Dosage of powder} \frac{\text{70 percent}}{\text{Percent chlorine in composition}} \times \text{dosage in 70-percent column}$$

$$\text{Dosage of liquid} \frac{\text{5 percent}}{\text{Percent chlorine in liquid}} \times \text{dosage in 5-percent column}$$

(C) Preparing the chlorine solution:

(1) *Chlorinated lime.* Place the proper amount of chlorine compound in a clean, dry container. Then add a small amount of water and mix to a thick paste. Dilute the paste by adding water gradually and stirring constantly until a gallon or 2 of the solution is obtained. Warm water is better than cold water for this purpose. Allow the solution to stand for 30 minutes, or until the undissolved particles settle to the bottom. Pour off the clear liquid (the chlorine solution) and, if necessary, filter it through muslin or cheesecloth;

(2) *H. T. H., perchloron, pittchlor, or equivalent.* Place the proper amount in a container, fill within a few inches of the top, and stir until the powder is dissolved (disregard slight turbidity, if any);

(3) *Liquid sodium hypochlorite.* These solutions require no preparation.

(D) Introduce the chlorine solution into that portion of the potable water system to be treated;

(E) Completely fill the units to be treated with potable water. Sufficient mixing will usually be obtained by the whirling action of the incoming water. Operate all affected potable water pumps until their chambers and suction and discharge piping are filled with chlorinated water;

(F) Open the taps and outlets nearest the affected parts of that portion of the distribution system being treated and allow them to flow until chlorinated water appears. Continue the process outward from the point of application until all taps and outlets have been flushed with chlorinated water. Care should be taken to fill the pressure tank, if it is involved, with chlorinated water. As a certain amount of the chlorinated water will have been drawn from storage tanks, if they are among the units to be treated, they should be refilled to overflowing and the chlorine solution added, as necessary, to maintain the 50 p. p. m. dosage in the system;

(G) After that portion of the system to be treated is filled, the chlorinated water should be allowed to stand in it for at least 4 hours. In an emergency, the contact time may be shortened to 1 hour by increasing the dosage to 100 p. p. m.;

(H) After the contact period, the treated portion of the system should be drained and flushed with potable water until the chlorine taste is no longer objectionable;

(I) The system or portion treated then is ready to be used for the storage and distribution of potable water.

1.33 STORAGE TANKS FOR WATER TO BE SUBSEQUENTLY TREATED. If water is to be stored aboard a vessel with the intention of treating it as it is needed for potable water, it may be stored either in independent tanks or in tanks formed by the skin of the vessel, deck, tank top, or partitions common with other tanks. However, the tanks should be free of apparent leakage and no sanitary drains (carrying hospital wastes and human sewage)

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should pass through them. The storage tank should not be cross-connected to the bilge system or any other system carrying highly contaminated liquids. If the material of which a tank is constructed should require coating, such coating should not render the water stored therein unfit for human consumption.

1.34–1.39 TREATMENT FOR THE PRODUCTION OF POTABLE WATER. Water treatment apparatus used aboard vessels for producing potable water should be designed and operated to produce only potable water.

Except for use in high pressure evaporators overboard water to be treated on vessels should be obtained from areas relatively free of contamination and pollution.

(A) *Distillation systems.* Distillation is the only satisfactory process aboard vessels for the production of potable water from river water. Lake water taken from areas remote from cities and other sources of pollution is satisfactory for use as potable water after it has been properly chlorinated. Water from approved shore sources that is properly loaded into nonindependent tanks meeting the provisions of item 1.33 may be used as potable water if it is properly chlorinated after it is drawn from the tanks.

(1) *Air gaps.* For a plant which will produce water for both nonpotable and potable water systems, the distillate should be supplied to the potable water tank and distribution system via a permanent connection. Distillate connections elsewhere should be via an air gap. Swing connections (reversible ell) between the distillate discharge piping or distillate tanks and the potable water system are not acceptable.

(2) *Distillation in atmospheric pressure or high pressure units.* This method of purification involves the evaporation of water at a temperature (212° F. or above) which inactivates all pathogenic bacteria. This process is capable of producing potable water from highly contaminated water.

This method of purification is the simplest to operate. Possible health hazards to guard against are flooding of the boiling chamber and corrosion leaks in the cooling coils of the condenser. The use of this method is rather limited, however, because of low production, high expenditure of heat, and frequency of tube cleaning. While the number of these limitations may be reduced in a vapor-compression type plant, the potential hazards remain essentially the same.

(3) *Low-pressure distillation.* The use of low-pressure evaporators on merchant vessels is of comparatively recent origin. They have the advantage of high rate of production, low expenditure of heat, and great reduction in the amount of water which must be stored on board. It is essential, from a health standpoint, that such plants consistently produce water containing not more than one-fourth grain of sea salts per gallon.

A salinity cell should be installed at a point somewhere beyond the final condensate cooler so that excess salinity of the distillate can be detected.

A flow diversion valve should be provided to divert the flow of water to waste when the salinity of the distillate exceeds one-fourth grain per

gallon. This valve should operate instantaneously and should be controlled by the cell that is located beyond the final condensate cooler. The electrical control of the valve should be arranged so that it will operate regardless of the position of the selector switch on the salinity indicator panel and the flow of water diverted from the potable water tanks when the current is off. An audible alarm to warn the operator when the salinity of the distillate exceeds one-fourth grain per gallon should also be provided.

(B) *Chlorination.* Chlorination is an acceptable method of treating clear, nonturbid water. Chlorine is introduced into the water in the hypochlorite form, either as a powder or a liquid. Liquid chlorine in cylinders should not be carried on vessels because of the hazard of escaping gas. Batch chlorination is unsatisfactory as a routine method.

The hypochlorinator should provide adequate service at variable rates of flow. It should function automatically with the operation of the potable water pump and should be equipped with some device for observing the flow of hypochlorite. A sampling cock should be appropriately located in the chlorination system so that the chlorine dosage and the operating efficiency of the feeder can be tested.

A fully equipped commercial testing kit for determining the chlorine (or chloramine) residual should be made available to the person responsible for the operation of the equipment.

When the water to be treated is chlorinated so that a residual of 0.1 to 0.2 p. p. m. is produced in the distribution system, there should be a holding tank of sufficient capacity to provide a contact period of 20 minutes for the chlorine and water. After the contact period, water may be delivered to the next successive treatment unit or to the distribution system. The maximum rate of flow through the tank should be computed on the basis of the rated capacity of the pump or pumps in the system. This tank should be baffled to thoroughly mix the chlorine solution and water and to minimize the possibility of short-circuiting the water through it.

If superchlorination is practiced, the contact interval for hypochlorite and water may be terminated after 10 minutes if the residual at that time is at least 5 p. p. m.

Superchlorinated water must be dechlorinated to remove excess chlorine and render the water palatable. Dechlorination may be accomplished either by introducing the proper amount of sodium thiosulfate or sodium bisulfite, or by passing the water through granular activated carbon. The latter method is usually practiced on shipboard by means of a bed of carbon in a pressure-filter type unit. All such dechlorinators should be equipped with a steam connection at the bottom, because neglected units may become incubators of after-growth bacteria. All carbon particles should be heated to at least 165° F. daily for satisfactory control. Dechlorination may be accomplished terminally by an element type filter (acceptable to PHS) without steam connections. Dechlorinating units should be

designed on the basis of 1 gallon per minute per square foot of surface area for each 10 inches of depth. While rates in excess of this may be handled in new filters, the ability of carbon to remove chlorine decreases with the passage of time.

If dechlorination is effected before the water enters the distribution system, it is still desirable to maintain a chlorine residual in the distribution system. This may be accomplished by bypassing a small amount of the superchlorinated water around the dechlorinating units.

(C) ***Filtration.*** Filtration should be used only when it is a necessary part of a purification system which includes a bactericidal treatment. Faucet and other types of terminal filters often collect and accelerate the growth of bacteria, and the storage and manual insertion of replaceable filter elements may be a means of introducing contamination. Because of these potential health hazards, the use of filters is discouraged unless some means is provided for disinfecting the filtering media after insertion and periodically thereafter.

Water that is loaded from approved sources through clean, separate hoses and into properly constructed and maintained storage tanks should not require clarification by filtration. If filtration is necessary, it should be accomplished with approved types of pressure filters. The filtering media should consist of at least 24 inches of hard filter sand, crushed quartz, or other suitable filtering material, supported either on a porous stone filter bottom or on a 12-inch bed of gravel. There should be a freeboard space above the sand of not less than 24 inches.

The optimum rate of flow through sand or quartz should not exceed 2 gallons per minute per square foot of filter bed area. Some method for automatically controlling the rate of flow should be provided. Control may be achieved with a pump, the maximum discharge of which is not greater than the rated capacity of the filter.

Backwashing with water of a quality at least equal to that of the filtrate should be accomplished at a rate of at least 15 gallons per minute per square foot of filter bed area, for a period of at least 10 minutes. Usually there is no real need for applying filter alum or for filtering to waste. The filter should be equipped with a loss-of-head gage, to indicate the need for backwashing the filter media.

Filters utilizing special filtering media such as anthrafilt may require less freeboard and may permit a higher filtration and a lower backwash rate than sand filters.

1.40, 1.41 DISINFECTING AGENT. An adequate supply of chlorine compound should be kept on board ship at all times to be used for producing water of potable quality or to disinfect replacements or repairs in the potable water system.

Instructions for the proper use of the chlorine compound should be available at all times.

Section II. WASH WATER

When a separate system is used for handwashing, bathing, and laundering purposes, the water should be of suitable sanitary quality and the system, if it does not meet the recommendations for a potable water system, should be so maintained as to minimize the possibility of contamination. Although the term wash water implies external use, there is a possibility that some of it may be ingested while bathing or when cleaning teeth. This is particularly true when potable water is not easily accessible and when wash water is the only source of water at a lavatory sink.

Water from the Great Lakes, and similar lakes, is generally satisfactory as wash water without prior treatment, when taken from areas free of drainage from shore or vessel. When water for washing purposes is to be taken from rivers, it should be filtered and chlorinated before use. The items on "Chlorination" and "Filteration" in section I should be considered with respect to the treatment of wash water, with these exceptions: (*a*) The contact tank will not be necessary if the chlorine dosage is at least 5 p. p. m.; and (*b*) the filtration rate through sand may be increased to 3 gallons per square foot per minute.

2.1 CONTAMINATED WATER. Grossly contaminated water should not be used for wash water unless adequately treated.

2.2 CROSS CONNECTION. There should be no cross connection between the wash water system and systems carrying bilge or other grossly contaminated liquids. Where it is necessary, under operating conditions, to require a connection to the ballast system, the ballast pumps which draw from or discharge to the wash water tanks should be provided with manifolds or lines that are independent of the suction and discharge manifolds or lines of the wash water pump.

2.3 DISTRIBUTION SYSTEM. The suction line to a wash water pump should be above the normal bilge water level.

Drains to bilges or waste pipes, and discharges to fixtures handling sewage wastes, should be protected against backflow, as specified in "Backflow Preventers," items 1.30, 1.31.

Wash water may be piped into the hospital or other medical treatment spaces for hydrotherapy and purposes other than handwashing incidental to

medical care. Wash water may be used for garbage disposal if the delivery line is protected against backflow and is properly identified. Wash water should not be piped into the galley, pantry, or scullery for dishwashing purposes except in the case of vessels on which heat-treated wash water was used for washing utensils prior to June 1947. Under these circumstances, the use of wash water for this purpose may be continued if controls are employed to insure that the water is heated to at least 170° F. before leaving the heater. The heater should be thermostatically controlled and located near the point of use.

2.4 WASH WATER FAUCETS. All faucets on a separate wash water system should be clearly marked by means of ½" lettering (minimum) stamped on a noncorrosive label plate, or equivalent, reading "UNFIT FOR DRINKING." In some cases, faucets for both potable and nonpotable water may be so located as to be indistinguishable from each other. To avoid confusion in such cases, it is advisable to label the potable water outlet "POTABLE." Bathtub outlets, shower heads, or bibb connections in shower spaces need not be so labeled.

Nonpotable water outlets should be properly identified.

2.5 STORAGE TANKS. Wash water storage tanks should be protected so as to minimize the possibility of contamination. Double bottom, fore or aft peak, wing or topside tanks, and tanks with a side common to another tank containing a nonpotable liquid, are satisfactory so long as they are free of leaks, are not traversed by sanitary drains, and have covered manholes and capped sounding tubes. When sanitary drains pass through a wash water tank, the water should be chlorinated before it is piped to the distribution system. A pipe tunnel may be constructed around the drain pipe, as indicated for potable water tanks in item 1.13. This would involve a major structural change which need not be made on vessels built prior to June 1947 (see footnote, p. 4). However, it is recommended as an alternative to chlorination.

When a deck forms the top of a wash water tank, all openings should be curbed and covered. The tank should be adequately protected against backflow or discharge of bilge or highly contaminated water.

Section III. SWIMMING POOLS

Fill-and-draw swimming pools should not be used.

3.1 RECIRCULATING POOLS. Recirculating swimming pools should be so equipped and operated as to provide complete circulation, replacement, and filtration of the water approximately every 6 hours or less during operation. They should be equipped with filters and chlorinators, and such other treatment equipment as may be necessary, in order to maintain the residual chlorine in the pool water at not less than 0.4 p. p. m. and the pH at not less than 7.

3.2 FLOWING-THROUGH POOLS. Flowing-through salt water swimming pools (the type most practicable for seagoing vessels) and their water supply systems should be operated to give maximum protection to swimmers. The water in these pools should be replaced approximately every 6 hours or less during operation.

The water supply system, including the pump, should be kept separate. The water intake should be located at the forward end of the vessel and beyond all sewage outlets. However, on the assumption that the pool will be filled and the flowing-through will occur only when the vessel is under way, fire or sanitary pumps, or a combination of both, can be used, provided:

(A) The delivery line to the pool is independent (i. e., it must originate at or near the discharge of the pump or the valve manifold, or at a point where the fire or sanitary pump and main are customarily flushed after the vessel leaves polluted water); and

(B) A readily accessible shut-off valve is located close to the point of take-off from the fire or sanitary water system and conspicuously labeled "KEEP CLOSED WHILE IN CONTAMINATED WATER."

Section IV. WASTE DISPOSAL

Liquid Wastes

Waste disposal from vessels must be accomplished without endangering the health of those on the vessel or in off-ship areas, for contamination by sewage may cause outbreaks of typhoid fever, paratyphoid fever, cholera, or dysentery.

The Public Health Service does not have definite requirements governing the discharge of sewage from vessels. Jurisdiction over the effluent quality in restricted areas rests with the cities and States concerned. Because these requirements vary considerably, local authorities should be consulted before the vessel enters a restricted area.

Drainage from and through food-servicing areas is covered in items 6.2 and 6.3.

4.1 GENERAL. Drain, soil, and waste pipes should be large enough, if properly maintained, to prevent clogging and backflow of sewage or contaminated wastes into the fixtures and spaces served.

4.2 DISCHARGE OF WASTES. Wastes containing sewage, food particles, or putrescible matter should not be discharged to the bilge.

4.3 VENTS AND TRAPS. Drainage systems which receive sewage, wash water, or putrescible wastes should be provided with vents and water-sealed traps to carry off settleable solids. The traps should be the same size as the drain to which they are connected. When an air gap is installed in a drain, the trap should be installed below the air gap. When discharged independent of other systems, a garbage grinder or a garbage chute may be provided with a backwater valve in lieu of a trap.

4.4 CLEANOUTS. Cleanout and "rodding" plugs should be installed at appropriate points in the drainage system. Means of opening and cleaning traps should be provided.

Cleanout and "rodding" plugs should not be installed in those sections of a drainage system which run overhead in spaces where food or eating utensils are stored or handled, or where refrigerating units are installed.

4.5 OVERBOARD DISCHARGE OF WASTES. Vessels should not discharge sewage, ballast, or bilge water in the vicinity of public water supply intakes, or in any other areas restricted by Federal, State, or local laws or regulations. On October 1, 1960, the Surgeon General of the Public Health Service designated areas around domestic water intakes in the Great Lakes and connecting waters as restricted areas. A copy of the Federal Register declaring these areas as restricted can be obtained from any appropriate regional offices listed at the end of this manual.

4.6 SANITATION IN TOILET ROOMS. All toilet rooms should be well-lighted, well-ventilated, and kept clean at all times.

Garbage

Improper handling and disposal of garbage on a vessel will attract flies and rats. If garbage is disposed of in a sanitary manner, both on the vessel and in areas likely to be affected by overboard discharges, health hazards will be avoided.

4.7, 4.8 FACILITIES FOR FOOD SPACE WASTE DISPOSAL. Prior to its removal from the vessel, all garbage should be received and stored in water tight, nonabsorbent, easily cleaned containers, both in the food handling spaces and in the open deck. To prevent nuisance conditions, garbage containers may be stored in refuse boxes or something similar and should be thoroughly washed when emptied. If necessary, they should be treated with a disinfectant. Where garbage cans are utilized, a designated space, or area, should be provided for washing garbage cans and should include steam or hot water under pressure, a hose equipped with an adjustable nozzle and a scrub brush. Garbage cans should be provided with close fitting lids and should be uncovered only when the containers are in use in galleys and pantries during the preparation of meals.

4.9 WATER SUPPLY FOR GARBAGE GRINDERS. Only potable water should be introduced into the hopper, or the grinder body of garbage grinders or disposal units when located in food spaces. Salt or wash water supplies may be used in garbage grinders which are installed in other designated garbage disposal areas. All feed chute openings should be fitted with closure doors to be kept closed at all times when the machine is operating except the hinge-swinging door which is opened if the garbage is pushed through. These salt water grinders should not be operated in polluted water.

Approved vacuum breakers or acceptable air gaps should be installed in the supply lines to garbage grinders that are flushed with potable or wash water.

Section V. VERMIN CONTROL

Vermin control, which includes control of insects and rodents, is an important factor in maintaining healthful conditions on a vessel. Cockroaches, flies, bedbugs, lice, mosquitoes, rats, rat fleas, and mice all are capable of transmitting disease. In order to suppress vermin infestation on vessels, continuous control measures are necessary and should be carried on under the direction of a vessel officer responsible for this work.

Insects

5.1–5.7 INSECT CONTROL. One or more of the following control measures should be employed:

(A) Eliminate enclosed spaces in which trash, food particles, and dirt may accumulate;

(B) Use screens on all structural openings to the outer air leading to food servicing spaces during those seasons when insects are prevalent;

(C) Clean frequently living quarters and spaces in which food is stored, prepared or served, or in which utensils are washed. Simple cleanliness, with frequent and abundant use of soap and water, is essential. Special attention should be given to areas which are difficult to reach;

(D) Properly store and dispose of trash and garbage; or

(E) Apply suitable insecticides. Insecticides and equipment for their use should be included in the ship's stores. Poisonous insecticides should be colored and marked "POISON." They should be stored at a distance from food-handling spaces to prevent them from accidentally being mistaken for foodstuffs.

Important factors in the control of insects are residual and space sprays. A residual spray is deposited on surfaces on which insects crawl or rest. Space sprays are released into the air as a fine mist or fog. They kill or immobilize insects immediately.

Residual sprays such as DDT and chlordane leave a number of minute but poisonous crystals on the treated surfaces which retain their killing effects for a considerable period after application. The residues from these sprays will kill insects as they emerge from their hiding places and crawl over the treated surfaces in quest of food.

Space sprays are quick-killing mists containing killing agents to which a small percentage of DDT may have been added. As commonly used,

they do not contain enough DDT for a satisfactory surface residue. Pyrethrum solutions are highly effective as space sprays, and if properly used they need not be mixed with DDT. If DDT is added to a space spray solution, the concentration should not be in excess of 3 percent. Piperonyl cyclohexanone is a dusting powder which is effective in killing insects. This material has the added property of driving insects out into the open when it is sprayed in holes, cracks, and other inaccessible areas. Other chemicals are being developed which eventually may prove suitable for insect control measures on vessels.

Foods, food contact surfaces, and utensils should be covered or removed during spraying operations.

Rodents

5.8–5.12 RODENT CONTROL. Because rats and mice manage to gain access to vessels despite numerous safeguards, it is necessary to adopt control measures for combating them. This section pertains only to the control of rodents on all types of United States ships, whether in interstate or foreign traffic, using control measures aimed principally at food storage, food preparation or food serving areas. Ships whose control measures and general housekeeping practices have, to all intents and purposes, eliminated rats and mice, will have no difficulty in complying with provisions of the following paragraphs.

Keeping down or eliminating the rodent population on a vessel may involve the use of poisons and traps. Poisons such as compound 1080, compound 42 (warfarin), zinc phosphide, thallin sulfate and ANTU are effective, particularly when large numbers of rodents are involved. Most of these rodenticides are toxic to humans, therefore instructions as to their use should be carefully followed. Compound 1080 is the most dangerous and should be used only by qualified pest-control operators or specially trained Public Health Service personnel, and then only under carefully controlled conditions.

Poisonous rodenticides should be colored, bear clear marks of identification, and stored remote from all foodstuffs.

Ratproofing an entire ship, including the elimination of harborages in all spaces, is not required for ships in interstate traffic. (See sec. VII regarding maintenance of ratproofing on ships in foreign traffic.)

Section VI. FOOD SANITATION

6.1 DECKS, BULKHEADS, AND DECKHEADS. Decks, bulkheads, and deckheads of all spaces in which food is prepared, served, and stored, or in which utensils are cleaned, should be kept clean at all times. Their surfaces should be smooth and kept in good repair.

If the deckhead consists of sheathed fibrous insulation, precautions should be taken to prevent particles of insulation from falling on food. Cloth or plaster surfacing will not provide satisfactory protection. Fibrous air filters should not be installed in deckhead areas of food spaces.

Perforated acoustical material is not acceptable in galleys, pantries, sculleries, or other food-handling and storage spaces. It may be used in dining spaces, however, if the sound-absorbing material is of such a nature or is so sheathed as to prevent particles of insulating material from falling through the holes and seams.

Dustless methods of cleaning should be employed and, except in emergencies, all surfaces should be cleaned during those periods when the least amount of food or drink is exposed.

6.2, 6.3 DRAINS AND GUTTERWAYS. A gutterway around the outer edge of the galley is satisfactory if it does not run behind or under any equipment and thus becomes inaccessible for cleaning. Cover plates over gutterways should be portable.

Deck drains should be provided with water-sealed traps and the deck or deck-surfacing material should permit proper drainage. A trap will not be required if drainage is piped directly overboard.

Drainage pipes should not pass directly over, or horizontally through spaces where food is stored or prepared, spaces where utensils are washed, or portions of spaces from which food is regularly dispensed. Where this condition exists, changes will not be necessary if the line throughout the space is free of clean-out plugs and flanges, or if existing clean-out plugs and flanges are welded and if the pipe is of extra heavy galvanized steel, or galvanized standard wrought iron with welded joints. Drains from refrigerated cargo holds may pass overhead, where necessary, within the holds.

6.4 NONPOTABLE WATER OUTLETS IN FOOD SPACES. Nonpotable water may be piped to the galley for deck washing purposes only. All outlets for deck washing should be properly labeled "FOR DECK WASHING ONLY," and should not be over 18 inches above the deck. Where overboard water is used, the outlet should be labeled "FOR DECK WASHING ONLY. DO NOT USE IN POLLUTED WATERS."

6.5 SCREENS FOR FOOD SERVICING SPACES. Some effective method should be adopted for excluding flying insects from spaces in which food is prepared or served, especially while the vessel is in port and during those seasons when the insects are prevalent. This can be accomplished by screening all structural openings from food spaces to the outer air with 16-mesh or finer noncorrosive wire, or with plastic cloth. Door screens preferably should open outward, and skylights above food spaces should be equipped with removable insect screens.

Either the inlet or supply outlet of natural draft ventilating ducts leading to food spaces should be covered with insect screening. Forced draft ventilation openings into food spaces should be screened. Tight-fitting, self-closing louvers are satisfactory (in lieu of mesh cloth) in forced draft exhaust outlets.

6.6 LIGHTING FACILITIES IN FOOD SERVICE SPACES. All working surfaces in food servicing spaces should be adequately lighted.

6.7 VENTILATION. All spaces in which food is prepared, served, or stored, except cold storage rooms, should be adequately ventilated. Natural ventilation should be supplemented by adequate exhaust fans and stove hoods.

6.8–6.10 IMPROPER USE OF FOOD SERVICE SPACES. Spaces where food is stored, prepared, or served should not be used for sleeping or living quarters. Clothing and personal effects should not be stowed or hung in food preparation spaces. They may be placed or hung in food serving and storage spaces, however.

6.11 FOOD SERVICING OPERATIONS. Manual contacts with food and drink should be avoided insofar as possible; fingers should not be used to serve butter or cracked ice. Sugar should be served in covered dispensers, containers, or wrapped packages for individual use.

Containers and utensils should not be handled by the surfaces which come in contact with food or drink. If used, paper cups, plates, straws, spoons, forks, and other single-service containers and utensils should be purchased in and stored in sanitary cartons and kept in a clean, dry place until used. After removal from the cartons, these articles should be handled in a sanitary manner.

Laundered cloths and napkins should be stored in a clean place until used.

When in intermittent use, spoons, spatulas, dippers, and scoops used for dispensing frozen desserts should be kept in running water or in water maintained at least at 170° F., or they may be cleaned and stored in a dry place after each use.

No animals or fowl should be allowed in any room in which food or drink is prepared or stored. Unnecessary loitering by persons not working in food preparation places should be discouraged.

6.12 PROTECTION OF FOOD SPACES AGAINST VERMIN. All spaces where food is stored, prepared, or served should be constructed and maintained with a view to excluding flies, rodents, and other vermin. (See items 5.1 and 5.17.)

6.13, 6.14 FOOD AND UTENSIL STORAGE. All stored food and drink should be protected from contamination by dust, flies, vermin, unnecessary handling, droplet infection, overhead leakage and condensation, and sewage backflow. Food should be stored in an orderly manner on racks or shelves well off the deck to protect it from dirt or water, to permit proper ventilation, and to facilitate cleaning of the space below. Utensils should not be stored on the bottom shelves of open type cabinets below dresser top level.

Whenever practicable, containers and utensils should be covered or inverted. Racks, trays, drawers, and shelves should be made of easily cleanable material and kept clean. Drawers should be removable, easily cleanable, of materials which are impervious, corrosion-resistant, nontoxic, smooth, durable, and resistant to chipping. Felt lined drawers are not acceptable. No polish or other substance containing cyanide preparation or poisonous material should be used in cleaning or polishing utensils. Lockers for stowage of cleaning materials and equipment should be provided in or adjacent to the food preparation space.

6.15 HEALTH OF FOOD SERVICE PERSONNEL. Any person who is known or suspected of carrying any communicable disease should not be permitted to prepare, handle, or serve food, water, or other beverages. This injunction applies also to any person known to be or suspected of suffering from a gastrointestinal disturbance, or who has on the exposed portion of the body an open lesion or an infected wound.

6.16–6.18 PERSONAL HYGIENE OF FOOD SERVICE PERSONNEL. All persons preparing, or serving food or drink, or handling utensils or equipment, should keep their clothes, body, face, hands, fingernails, and hair clean. At least immediately prior to coming on duty, after interruption of duty, or after visiting the toilet, all such personnel should wash their hands thoroughly with soap and hot water and dry them on individual (preferably single-service) towels provided for this purpose.

Spitting and the use of tobacco in any form should not be permitted in the galley, pantry, or scullery.

6.19 POTABLE WATER FOR FOOD SERVICE SPACES. Potable water, hot or cold, should be piped under head or pressure to galleys, pantries, or

sculleries. If only cold potable water is piped to these spaces, adequate facilities should be installed to heat the water for cleaning and for the bactericidal treatment of dishes and utensils. On vessels on which it had been the practice (prior to June 1947) to wash utensils with heat treated wash water, this practice may be continued, if a heating device is installed which will be integral to the bactericidal treatment vat and which, preferably, should be thermostatically controlled. This device should be capable of—

(*a*) within 5 minutes raising the temperature of the water in the vat to 170° F. or higher.

(*b*) maintain the water temperature in the vat at 170° F. or higher during dishwashing operation.

6.20 UTENSIL WASHING. All multiuse eating and drinking utensils should be thoroughly cleansed in warm water and subjected to an effective bactericidal treatment after being used. All other utensils that come in contact with food and drink should be similarly treated following each day's operation.

Thorough washing of utensils may best be accomplished with warm water containing sufficient detergent to remove grease and solids. Water at a temperature of 110° to 120° F. is best suited for the handwashing of utensils.

Careful scraping or prerinsing of utensils to remove gross food particles before washing is recommended as a means of keeping the wash water clean longer and of maintaining an effective concentration of detergent. The wash water, however, should be changed at sufficiently frequent intervals to keep it reasonably clean.

6.21–6.25 BACTERICIDAL TREATMENT. After a thorough washing, eating and drinking utensils should be subjected to an effective bactericidal treatment, by one or more of the following methods:

(A) By immersing the utensil or equipment for at least 2 minutes in clean hot water at a temperature of at least 170° F., or for one-half minute in boiling water (212° F.).

Hot-water sanitization of utensils may best be accomplished in a two-vat sink and with long-handled wire baskets. The first vat should be used to wash the utensils, after which they should be placed in the wire baskets and immersed in clear hot water in the second vat for the required length of time (see preceding paragraph). Cups, bowls, and glasses should be so placed in the wire baskets as to prevent the formation of air pockets and to permit water to drain off readily. After being removed from the hot water, utensils should be left in the baskets until dry.

In some special cases, where a small number of utensils are involved, such as on freight ships with crews of 10 or less, acceptable bactericidal treatment may be given in a single-vat sink used for both washing and bactericidal treatment, or where another receptacle is also used, provided

that in such special cases the dishes are observed actually to receive separate satisfactory washing and bactericidal treatment.

Facilities for the bactericidal treatment of eating and drinking utensils will not be required in the captain's or master's pantry because this space is not used for group feeding.

If a scullery is located near a galley or a pantry, facilities for washing utensils need not be provided in either of the latter spaces.

Water in the bactericidal treatment vat should be maintained at the required temperature for the entire dishwashing period. To compensate for loss of heat and to prevent frequent replacement of water, a supplemental heating device should be provided for the bactericidal vat. This device should be capable of—

(*a*) within 5 minutes raising the temperature of the water in the vat to 170° F. or higher.

(*b*) maintain the water temperature in the vat at 170° F. or higher during dishwashing operation.

Some satisfactory devices for maintaining the water temperature are as follows:

1. A steam or electrically heated jacket under or around the vat.
2. Steam coils within the vat, provided such a unit is removable or can be rotated to a vertical position for routine cleaning.
3. A removable, immersion-type electrical unit in the vat.
4. One or more ejectors at the bottom of the vat (they should be installed so that they thoroughly mix the stream and the water).
5. A steam or electrically heated recirculation unit attached directly to the bactericidal vat.

Where hot water is used as the bactericidal agent, an indicating thermometer should be provided to measure the temperature of the water in the treatment compartment. Dial type thermometers, with the dial attached either to the splash plate of the sink, the adjoining bulkhead or some other easily visible location, are preferable to general purpose hand thermometers.

(B) By immersing utensils or equipment for at least 2 minutes in a lukewarm chlorine bath containing at least 50 p. p. m. of available chlorine. Other chemicals will be considered for use on their merits.

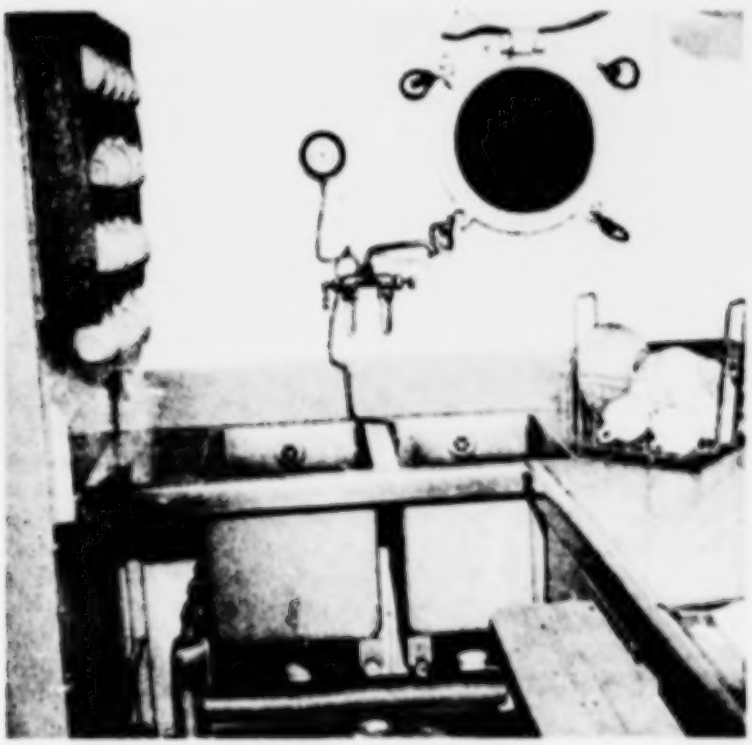
When using this method of bactericidal treatment, a three-vat unit is desirable: one unit for washing, the second for rinsing, and the third for chlorine immersion. Because the strength of chlorine is depleted rapidly by organic matter (food particles and grease) and by the detergent that may be carried over from the wash vat, an effective rinse after washing and before immersion in a chlorine solution is necessary. In order to maintain the recommended strength of 50 p. p. m. of available chlorine during the washing operation, the bath initially should be made up to a strength of 100 p. p. m. and should not be used after its strength has been reduced to 50 p. p. m.

Testing sets should be used for determining the chlorine residual in the sanitizing vat.

(C) In the case of utensils or equipment so designed or installed as to make immersion or exposure impracticable, the following treatment methods may be employed:

1. Live steam from a hose, if the steam can be confined,
2. Boiling rinse water, or
3. Spraying or swabbing with chlorine solution.

(D) Any other method determined by the Surgeon General (upon application of an owner or operator of a conveyance) as sufficiently effective to prevent the spread of communicable disease.



Suitable manual dishwashing facilities simplify the important job of sanitizing dishes.

6.26 DISHWASHING MACHINES. For effective cleansing of utensils, the wash water temperature should be in the range of 140° F. Obviously, long washing periods are more effective than short ones, as detergent action, like other chemical reactions, requires time for completion. Acceptable

results may be obtained with wash periods of at least 30 seconds to 1 minute duration.

The concentration of the detergent in dishwashing machines should be maintained as constant as possible if it is to retain its effectiveness. Automatic detergent-dispensers are preferable to hand methods for this purpose, especially for single-compartment machines where the wash water constantly is being diluted with rinse water.

Racks or trays containing utensils should not be overcrowded; the wash and rinse waters should reach all surfaces of each utensil.

Dishes, cups, bowls, saucers, and the like should not be nested or overlapped, but should be inclined slightly.

When washing utensils by machine, acceptable results may be achieved with the rinse water heated to 180° F. in the final rinse line at the entrance of the rinse manifold in the machine. The minimum time for rinsing should be 10 seconds. This time-temperature relationship is recommended on the assumption that each rinse will be preceded by an adequate wash.

Thermometers for both the washing and rinsing processes should be readily visible and should indicate accurately the temperature of the water being used in each process.

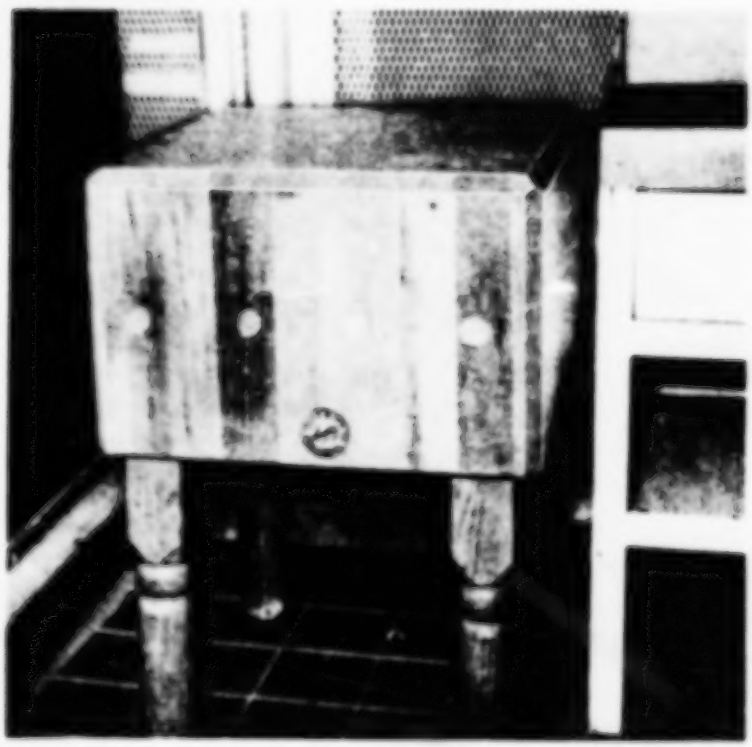
6.27 HANDLING OF UTENSILS AFTER BACTERICIDAL TREATMENT. It is preferable for utensils to drain dry after bactericidal treatment without the use of drying cloths.

The use of a crash cloth on which to store temporarily dishes and utensils previously subjected to a bactericidal treatment is not desirable. If a crash cloth must be used, however, it should be kept clean and changed frequently.

6.28 CONSTANT TEMPERATURE BOTTLES. Constant temperature bottles and other containers used for storing and dispensing potable water or other liquids should be kept clean at all times. They should be subjected to an effective bactericidal treatment at least once a week and especially after each occupancy of the space in which used.

6.29–6.31 CONSTRUCTION AND MAINTENANCE OF UTENSILS AND EQUIPMENT. All sinks, dishwashing machines, cases, counters, drawers, shelves, tables, stoves, hoods, machinery, meat grinders, can openers, butcher equipment, meat blocks, cutting boards, knife racks, and all other food contact surfaces and equipment should be constructed so that they can be easily cleaned. They should be kept clean and in a state of good repair. Galvanized metal for table tops, etc., are not acceptable. The lid of steam kettles, if so designed as to consist of two parts, should be constructed with a lip arrangement that overlaps the hinge seam. This prevents dirt, grease, and contaminated matter from dropping into the kettle when the lid is opened. Vent lines from the steam kettle, if provided, should terminate in

the galley space pointing downward and should end at a point at least 18" above the deck. If the vent extends out to an open deck, it should be screened with 16 mesh corrosion-resistant wire which is detachable for cleaning. With either arrangement, the construction features of the vent should permit easy cleaning of the line.



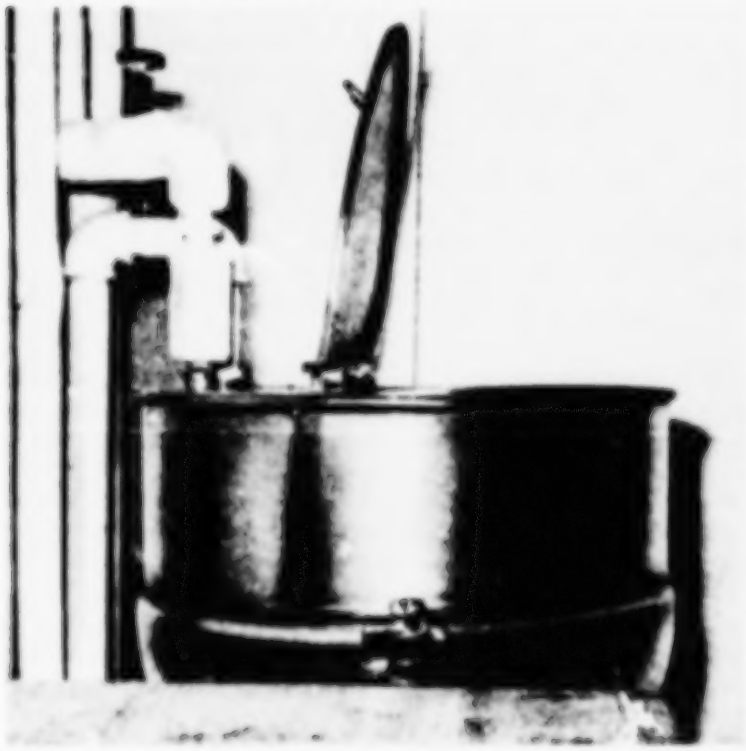
A well constructed and properly located meat block can be easily cleaned.

6.33–6.34 STORAGE OF PERISHABLE FOODS. All perishable food or drink should be kept at or below 50° F., except during preparation or when kept hot for immediate serving. Perishable food or drink includes all custard-filled and cream-filled pastries, milk and milk products, egg products, meat, fish, shellfish, gravy, poultry stuffing, and sauces, dressings and salads containing meat, fish, eggs, or milk and milk products.

All refrigerators should be constructed so that they can be cleaned without difficulty. They should be kept clean, free from objectionable odors, and in good repair.

Waste water drains from ice boxes and refrigerated spaces should meet the recommendations contained in item 6.2.

Recommended temperatures for various types of food are as follows: frozen foods, 0° to 10° F.; vegetables, 44° to 50° F.; fish, 33° to 38° F.; milk, 40° to 46° F.; dry stores, 50° to 60° F.



Food cooked in a kettle similar to the one shown above is well-protected from contamination.

6.35 DEFROSTING OF REFRIGERATION COILS. If salt water from contaminated harbors or other areas is used to defrost exposed coils within the refrigerated space, it should first be heated to 165° F. It can then be allowed to cool to the temperature desired for defrosting. Heating the water to 165° F. is not required when open sea water (which is relatively free of contamination) is used.

The use of salt water for defrosting without the heat treatment is acceptable when the defrosting operation is performed within an enclosed refrigeration unit located in the fan room space apart from the stored cargo.

6.36 THERMOMETERS FOR REFRIGERATORS. Each refrigerator where perishable foods are stored should be equipped with a thermometer

located in the warmest portion of the space. Design peculiarities of many small units make it difficult to lower the temperature to 50° F. or less. Other units, after being open a short time, are slow to reduce the temperature to the desired level.

A thermometer is not required in a small commercial refrigerator intended for personal use, such as that installed in the captain's pantry. This will also be true of small refrigerators in galleys and pantries used to store food for crew members during periods when food is not formally served.

6.37 DRAINS FROM FOOD SPACES. Air gaps will be required in drain lines from dishwashers and equipment used in the preparation or processing of food, if the drainage runs to a system receiving human sewage [1] or hospital wastes. Individual air gaps are not essential in these drain lines, however, if item 11, Section F of the current "Handbook on Sanitation of Vessel Construction" is satisfied.

6.38, 6.39 TOILET FACILITIES FOR FOOD HANDLERS. Toilet facilities for food service personnel should be available, preferably on the same deck as the galley, and should be for the use of food handlers only, except on smaller vessels where food service personnel share the toilet facilities with other departments. Toilet facilities on the deck above or below the deck on which the galley is located, including those in crew's quarters, will be acceptable if they are not too far removed from the galley space. In all cases such facilities should be accessible at all times.

Preferably, toilet rooms should not open directly into spaces where food is stored, prepared or served, or in which utensils are handled or stored. If this is not possible, the doors separating such spaces from toilet rooms should be tight-fitting and self-closing.

6.40, 6.41 HANDWASHING FACILITIES FOR FOOD SERVICE PERSONNEL. Handwashing facilities should be provided in or adjacent to the toilet facilities and include hot and cold running potable or wash water, single service paper or cloth towel dispenser or electric drying machines, a suitable soap, detergent, or other acceptable cleansing agent, and a sign over the lavatory reading "WASH HANDS AFTER USING TOILET."

Handwashing facilities should also be provided in the food preparation spaces listed below for use by the personnel working in these areas to keep their hands clean during their activities. These facilities should include the above appurtenances except only hot and cold potable water should be used and a sign reading "WASH HANDS OFTEN" in lieu of "WASH HANDS AFTER USING TOILET" should be located over the lavatory. This

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[1] Human sewage is defined as liquid wastes containing human excreta; excreta includes feces, urine, secretions from the skin, and spittle.

One of the most important factors in food sanitation is personal cleanliness.

wording should also be used where a common lavatory serves both the toilet facility and the food preparation space—

(a) central commissary (additional lavatories may be needed when distance, partitions or other impediments might prevent convenient use of the facility).

(b) individual galleys, pantries, scalleries, bakery shops, butcher shops, and vegetable preparation rooms (a single lavatory may serve two or more such areas if easily accessible to each).

On vessels where handwashing facilities are provided, as indicated above, in the food service employee's stateroom and that stateroom is located convenient to the food preparation space, handwashing facilities are not required in the food preparation space. In this case, a cloth towel for the individual use of the food service employee is acceptable. Slop sinks and scullery sinks are not satisfactory as handwashing facilities.

6.42 QUALITY AND PROTECTION OF FOOD. All food and drink should be clean, wholesome and free from spoilage. It should be stored, handled, prepared, and served in this manner.

6.43, 6.44 MILK AND MILK PRODUCTS. All milk obtained from shore sources in the United States, or in nearby foreign countries, should be pasteurized. Moreover, the sources of supply should be approved by the Surgeon General. Milk for table use should not be procured in large bulk containers from which it is subsequently transferred to pitchers and glasses by dippers or by pouring. Milk, buttermilk, and milk beverages should be served in or from the original containers received from the distributor, or from a bulk container equipped with a dispensing device so designed, constructed, installed, and maintained as to prevent contamination of the contents. The original containers preferably should be of a size designed for the use of the individual consumer.

6.45 ICE. All ice should be made, stored, and handled in such a manner as to prevent contamination. Prior to its use, all ice, except that which may be delivered to the vessel in sealed containers, should be thoroughly washed on board the vessel with potable water.

Ice cubers and/or flake ice machines should meet all requirements regarding submerged potable water inlets, air gaps in overflow and drain lines, the use of nonabsorbent materials and the use of those parts whose water contact surfaces are smooth and easily cleanable.

6.46, 6.47. SHELLFISH. Shellfish that have been taken from contaminated waters, or that have been handled in an insanitary manner, are capable of transmitting a number of intestinal diseases. Therefore, raw shellfish purchased for use aboard vessels should be obtained only from dealers whose names appear on the current list of certified shellfish shippers issued by the Public Health Service. Shucked raw shellfish should be purchased in the containers into which they were packed at the shucking plant and should be kept in the vegetable cooler or thaw room of the meat box until used. Such containers should be marked with the name of the plant, the abbreviation of the State in which the shellfish were packed, the certificate number of the shipper, and the date of packing. The latter may be recorded in code.

Persons desiring to be placed on the Public Health Service mailing list of approved shellfish shippers should communicate with the nearest U.S. Department of Health, Education, and Welfare regional office. (See addresses on inside of back cover.)

Section VII. RATPROOFING

The ratproofing requirements listed herein apply only to United States flag vessels engaged in foreign traffic. Ratproofing of interstate carriers is not required.

Ratproofing activities on operating vessels should, for the most part, be confined to maintaining in good condition the ratproofing which has been built into the vessel, as it is often impractical to install ratproofing where it was omitted during construction.

If the vessel is to be maintained in a reasonably satisfactory ratproof condition, certain basic practices should be observed in all parts of the vessel regardless of existing conditions. These are as follows:

(A) Additional ratproofing will not be required in certain spaces unless rat harborages exist as a result of improper maintenance. Ratproofing which may have been damaged should be replaced or repaired with material similar to that used in the original construction.

(B) Ratproofing is required for concealed spaces and structural pockets which cannot be inspected.

(C) Openings greater than one-half inch which lead into void spaces or spaces where food is stored or prepared should be ratproofed. In other spaces, openings in single bulkheads should be closed with material similar to that used in the construction of the bulkhead. Double bulkheads, deckheads, or void spaces should be ratproofed only with material that cannot be gnawed by rats.

(D) Collars should be installed around penetrating fixtures, regardless of the size of the space or its location. Collars around pipes or cables should extend to within one-quarter inch of the penetrating member. Collars around pipes which are covered by insulation not over one-half inch in thickness are satisfactory if fitted snugly against the insulation. Pipes with insulation in excess of one-half inch thickness should be collared with sheet metal and the collar should extend into the insulation in such a manner as to leave an opening the diameter of which is not greater than the diameter of the pipe plus one-half inch.

(E) Flashing may be necessary in repairing existing installations. Flashing at decks or horizontal ledges on which rats may stand and gnaw should be installed on the exposed sides of double bulkhead partitions. The ratproofing material may vary from channel protection, where hard composition materials are used, to 6-inch sheet metal on surfaces subject to a great deal of damage, such as cargo holds.

(F) Sheet metal to be used in the form of flashing or collars should be 22 gage for living quarters and dining or public spaces, 18 gage for refrigerated or semipublic spaces, and 16 gage or heavier for cargo holds and spaces which are more or less isolated. Lead, putty, duct seal, steel wool, cement, wood, wood fiber, and the like, are not considered ratproofing materials and should not be used to protect areas in which rats may harbor.

The information that follows is intended to serve as a guide to ratproofing spaces and facilities (before considering each item, reference should be made to the basic considerations (A) through (F) above):

(1) *Structural features.* Structural pockets, including shell, bulkhead and deckhead stiffeners, lightening holes and void spaces in the fore and after peak, need not be ratproofed, except as stated under (A) through (D).

(2) *Living quarters, dining rooms, and public spaces.* No ratproofing is required in these spaces other than what was built into the vessel at the time of construction, except as stated under (A) through (D).

(3) *Cargo holds.* Ratproofing of cargo pads, bilge ceilings, and screen bulkheads, or any place in a cargo hold, is required when (*a*) they are constructed of nonratproof material, and (*b*) the space between the pad or screen and the steel surface is greater than three-fourths inch. Ratproof construction of wireways and pipe guards is not essential unless they are completely enclosed, in which case they should be ratproofed as stated under (A) through (D).

(4) *Refrigerated spaces.* No ratproofing should be requested in these spaces, except as stated under (A) through (D).

(5) *Food storage spaces.* With the exception of the boundary surfaces, no ratproofing should be requested within these spaces if they are already constructed of nonratproof materials, except as stated under (A) through (D).

(6) *Other storage spaces.* No ratproofing should be requested, except as stated under (A) through (D).

(7) *Deck gratings.* Existing gratings should be accepted, regardless of construction or the space in which they are used.

(8) *Flooring.* Flooring in most public spaces need not be ratproofed. Floorings in cargo holds are covered in item (3) above. If solid raised flooring of nonratproof material exists in food spaces (including storage) it should be ratproofed.

(9) *Wireways and pipe guards.* Ratproofing of wireways and pipe guards in public spaces is not essential, unless they are completely enclosed, in which case items (A) through (D) apply.

(10) *Insulated pipes or ducts.* Ratproofing is not essential in any location, except as stated under (A), (C) and (D).

(11) *Machinery and deck equipment.* Same as item (10) above.

(12) *Lockers and boxes.* Lockers used for storing food should be ratproofed. Requirements as to height of lockers and boxes above the deck should be waived. Spare parts boxes need not be ratproofed, regardless of

location, except large permanent type enclosures such as those used for stowage of propellers.

(13) *Furniture and fixtures.* No ratproofing is required, except as stated under (A).

(14) *Fire stations and lifeboats.* Same as item (13) above.

(15) *Ventilation openings.* The openings should be screened except where normally exempt by reason of location and nature of the construction.

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Public Health Service

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